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ABSTRACT

The passage comprehensibility of three diagnostic reading tests--the Stanford Diagnostic Reading Test, the Spache Diagnostic Reading Scales, and the Durrell Analysis of Reading Difficulty--was evaluated using the following text variables: content familiarity, vocabulary, the number of idea units in the text, the number of text-based inferences required to integrate ideas, the existence of main idea statements, and the logical sequence of ideas in the passage. Selections from the second, fourth and sixth reader levels were evaluated to identify passage characteristics across reader levels and test inconsistencies. With regard to text variables, each selection was transformed into a series of propositions or ideas. Also, eight graduate students rated each selection for content familiarity. With regard to readability formula variables, a computer program was used in which each passage was evaluated in terms of four readability formulas: The ARI, Flesch-Kincaid, Harris-Jacobson, and the Dale-Chall. Results showed that the three tests differed substantially in the number of ideas presented, the number of inferences necessary to integrate these ideas, and text organization features. The readability indices reflected only surface features of the text and did not reflect the meaning characteristics of the passage nor identify the variables integral for deriving meaning from the text. (HOD)

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An Analysis of Text Variables in Three Current Reading Diagnostic Tests

Considerable research has been conducted examining the text variables which influence comprehension. Collectively this research has indicated that variables such as content structure (Meyer, 1975), propositions (Kintsch & Keenan, 1973), and implicit/explicit connectives which establish relationships between ideas in a text (Marshall & Glock, 1978-79; Irwin, 1980) can facilitiate or inhibit comprehension perfo ance. In addition, the degree of prior knowledge the reader brings to the to can increase or decrease text processing demands (Kintsch, 1979; Marr & ley, 1982). These findings have significance not only for instructional pu of reading comprehension proficiency. If identify a student's comprehension abilit tematically controlled when test comprehension need to be identified and sy the diagnostician to distinguish passages are constructed thereby permittirom the comprehensibility of the the student's comprehension proficiency fnostic tests have failed to text. At present, authors of reading diag mprehension ability and text construct such passages thus confounding c reading comprehension problems a comprehensibility, making the diagnosis of most difficult task.

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To further illustrate this point, this paper identifies several text variables which have not been controlled in passages selected from three commonly used reading diagnostic tests and discusses how these test passages may, in fact, inhibit comprehension.

Readability Formulae

Traditionally, readability formulae have been used as indices of the difficulty level of text; that is, as an index which predicts the number of questions a child may answer correctly from a particular passage. Many of these early formulae were validated on selections from the McCall Crabbs Standard Test Lessons. Surface features of the text such as the number of words in a passage or the number of sentences in a passage were used in a linear regression formula to predict the difficulty level of a passage (Klare, 1974-75). Several proponents of readability formulae recognize that these formulae are predictive indices only, and that they were not designed to cause ease or difficulty in reading text nor provide assurance of improving readability (Klare, 1974-75). Unfortunately these formulae are not being used as they were intended. In fact, many individuals use these formulae as guidelines for increasing or decreasing the reading level of a passage. All too frequently individuals controlling [illegible] match the text with the reading levels of the students for whom the passage was intended. As a result, problems related to text comprehensibility occur. When an original text is adapted to decrease readability, complex sentences are frequently divided into simple sentences and vocabulary is simplified.

Since the relationships between ideas in the sentenes becomes implicit, paradoxically the processing demands and inferencing skills required of the reader are increased (Kintsch & Vipond, 1979; Pearson, 1974-75). Also, topic sentences are frequently deleted eliminating an integrative device for the reader. As Davision and Kantor (1982) note, readability formulae not only don't define readability, but can be misused such that they in fact decrease the comprehensibility of text.

Although there are numerous readability formulae available most use only a few variables to determine the level of difficulty of a passage. These variables occur at the word or sentence level and include: a) word frequency, b) number of letters in a word, c) number of syllables in a word, d) number of words in a sentence, and e) number of sentences per passage (Klare, 1974-75). While researchers have examined other sentence characteristics such as prepositional phrases, degree of subordination, and passive verb forms, these variables have been less strongly correlated with readability criteria. As a result, word frequency, word length, and sentence length have remained the three variables most widely used in readability formulae due to strong predictive power and ease of use (Seldon, 1981).

Text Variables

Research investigating the manipulation of various text variables has been conducted in which text variables have been manipulated and the effects evaluated in terms of subsequent comprehension performance. In particular, several text variables have been found to influence the comprehensibility of text. Kintsch and Vipond (1979) summarize the effects of these variables in their chapter

noting that the number of idea units in a passage, the number of different arguments used in a text base, the number of explicit connectives between sentences, and the number of inferences required to connect the text base can increase or decrease the processing demands made on the reader. Kintsch (1979) defines reading difficulty in terms of the meaning characteristics of the text and the processes required of the reader to extract this meaning. He suggests that a formula of reading difficulty should include such variables as: numbers of reinstatement searches (the search of long term memory to match with information in the text), word frequency, idea unit density (the number of words per ideas expressed), the number of inferences, the number of processing cycles (cycles necessary to pick-up, match and store information in memory), and the number of different arguments (repeated ideas) in a text base. Similarly, other researchers have found that the content structure of the text (Meyer, 1975) and the main idea statements (Marshall & Glock, 1978-79) can influence comprehension. Further, reader variables such as purpose for reading and or prior knowledge of the topic can compensate for poorly organized text and increase the amount of text processed (Kintsch & Vipond, 1979).

For the purpose of this paper the following reader and text variables were [illegible] statements, and the logical sequence of ideas in the passage.

METHODS

Materials

Three reading diagnostic tests were selected for evaluation. Criteria for selection included recency, frequency of use in the schools, and measurement of comprehension performance. The three tests selected were: the Stanford Diagnostic Reading Test (SDRT), a group test assessing comprehension via literal and inferential questions; the Spache Diagnostic Reading Scales (Spache), an individually administered test also using questions to assess comprehension; and the Durrell Analysis of Reading Difficulty (Durrell), an individually administered test assessing comprehension via a recall and probe question technique. Selections from the second, fourth and sixth reader levels were evaluated to identify passage characteristics across reader levels and test inconsistencies.

Procedures

With regard to text variables, each selection was transformed into a series of propositions or idea units (Kintsch, 1974). In this manner, the number of idea units and text-based inferences required to integrate ideas could be quantified for each passage. Also, eight advanced level graduate students rated each selection with regard to content familiarity. Using a high, medium, low scale, they rated each passage in terms of its relative familiarity to students whose grade placement corresponded to the reader level for which the passage was intended.

With regard to readability formula variables, an apple computer program was employed in which each passage was evaluated in terms of four readability formulae: the ARI, Flesch-Kincaid, Harris-Jacobson, and the Dale-Chall (see Klare, 1974-75, for a detailed description of these formulae).

RESULTS AND DISCUSSION

Second Reader Level Passages

In an attempt to maintain a low readability index, passages written at the primary reader levels are typically very brief consisting of short, disjointed simple sentences and a simplified vocaulary. These passage features increase the processing demands for the reader, because concepts are vaguely defined (Langer, 1982) and the reader has to infere the missing information (Marshall, 1979; Beck, McKeown, McCaslin & Burke, 1979). Thus, in an effort to reduce the readability of these passages, the authors have, in fact, decreased their comprehensibility.

As noted in Table 1, all three passages were designed to assess second reader level comprehension skills. However, they vary considerably with regard to length (SDRT, 53 words and Spache, 119 words) and readability estimates within one passage (3.0 and 4.7 SDRT). This variability not only suggests that the passages are not comparable but also calls into question the utility of readability indices designed to identify the reader level of the passage.

INSERT TABLE 1

An examination of the text variables contained in each of the passages reveals a few points worthy of attention. First, although content familiarity is generally medium to high across all three selections thereby facilitating comprehension, the number of idea units expressed in each passage varies considerably from 20 to 50 thus altering the processing requirements of each of the tests. As Kintsch and Keenan (1973) note, an increase in the number of propositions in a selection increases the processing time for that passage. Second, the number of text-based inferences required to integrate ideas in the passages varies from 5 (Durrell and SDRT) to 15 (Spache). Thus, even though all three selections are designed for the second reader level, the Spache requires more text-based inferences if comprehension is to occur. Third, main idea statements are not present in all three passages. In the absence of such statements the reader must infer the gist or main idea of the selection thereby increasing processing demands. A comparison of the three test passages reveals that the Spache provides a main idea statement in the first sentence of the paragraph. The Durrell does not contain such a statement; however, it does have a title which could serve as an advanced organizer for the reader. No main idea statement is present in the SDRT passage, making the task of identifying the gist of this selection quite a challenge. In addition the sentences of this paragraph do not appear to be logically related. The selection begins with the statement, "Barbara lived in a city...," then follows with, "playing baseball in the park" and "eating lunch" and closes with, "cows eat chocolate grass."

Text organization can also influence comprehensibility. The Spache selection appears to suffer from what Langer (1982) calls imitation genre. That is, the text deviates from the expected genre pattern and creates confusion for the reader. In this selecton the first sentence is a main idea statement, "...Bob took a trip to the zoo." followed by sentences about what occurred when he first arrived at the zoo. The selection proceeds to a second paragraph which begins, "on the way out of the park..." completely omitting information related to what occurred during the visit and violating the reader's schema for the structure of the text (Meyer, 1981). This selection also contains an illogical sentence which might create confusion and comprehension difficulty for the reader. The sentence, "The cages were clean, but the lions didn't seem to like them..." leads the reader to believe that lions like cages if they are clean, contrary to what most readers have previously learned.

In sum, all three test passages suffer from a lack of systematic control of text variables thus decreasing their comprehensibility. However, of the three passages evaluated at this level, the Spache appears to be the most difficult to comprehend because of its number of idea units, number of required inferences, and imitation genre features.

Fourth Reader Level Passages

Readability indices and text variables for passages at the fourth reader level are also listed in Table 1. In general, these passages differ from the second reader passages in terms of content familiarity, length, number of

text-based inferences and content structure. These selections are most difficult to comprehend because they are written about less familiar topics (e.g. steamboats and bananas), they are longer, contain a greater number of idea units and required text-base inferences per passage (almost twice as many), and they are expository rather than narrative in nature (Meyer, 1981).

Consistent with the findings at the second reader level, the Spache passage is almost twice as long as the other two selections. It has increased in length from 119 words to 216 words and in the number of idea units from 50 to 95. The Durrell selection has also almost doubled in length and number of propositions while the SDRT passage has changed only moderately from 53 to 88 words and from 22 to 35 idea units. The readability indices vary across the passages from 4.9 to 6.9, although they appear to fluctuate less within a selection than was noted previously perhaps due to the explicit nature of the passages at this level.

An examination of the text variables in each of the passages also reveals observations consistent with those found at the second reader level. The Durrell passage contains six more words than the SDRT, but both passages contain the same number of idea units. A comparison of the number of inferences between passages reveals that although the Durell and SDRT contain the same number of idea units, the Durrell requires a greater number of text-based inferences to link these ideas together. These findings illustrate the significant difference between readability variables such as passage length and text variables such as idea units and text-based inferences which influence comprehensibility.

The presence of main idea statements in the passages continues to vary at this level. The Durrell passage contains a title and a main idea statement in the first sentence of the paragraph. The selection is presented in logical order and contains explicit connectives which establish relationships between ideas in the sentences. While the SDRT did not provide a main idea statement at the second reader level, at this level it does have a main idea in the form of a prequestion which serves as an excellent advanced organizer for the reader. Perhaps the authors felt such a feature was important to the comprehension of unfamiliar, expository text. The Spache selection does not contain a main idea statement and continues to lack strong text organization. Some of the sentences in this passage also contain cohesive ties which appear inappropriate and create further confusion for the reader. For example, "He (John Paul's brother) was eager to talk about the wonderful country, but John Paul already loved America." or "Nothing unusual happened, but everyday was a real adventure for the new ship's boy."

Even though all three passages differ with regard to the text variables, the Spache selection appars to have the greatest number of idea units and required text-based inferences. To add to the difficulty of this passage, it does not contain a title or main idea statement and is poorly structured, containing disjointed ideas and inappropriate connectives. The Durrell and SDRT remain a bit more comprehensible and comparable.

Sixth Reader Level Passages

Table 1 contains the readability indices and text variables for passages at the sixth reader level. These selections are all expository in nature and describe relatively unfamiliar topics: fleas, building stone, and the history of golf.

An examination of surface text features reveals patterns similar to those found at the other two reader levels. The test passages all vary with regard to length (88 to 188 words) and readability indices (from 5.4 to 9.12 reader levels), although readability measures remain more stable for the Durrell and SDRT selections. Main idea placement patterns were similar across the fourth and sixth reader level passages. The Durrell selection contains a title which serves as its main idea and the SDRT contains a main idea statement in the first sentence. Conversely and consistently the Spache doesn't provide any explicit main idea statement.

At this level some different text variables are present. The Durrell selection contains a few difficult vocabulary words such as "relented" and "indulge;" however, both terms are defined implicitly by the context of the selection. This selection also contains some less familiar expressions such as, "gained a wide following" and "grown in favor" as well as complex sentences thereby increasing the processing demands of the text. However, this selection is well structured to facilitate comprehension.

The SDRT selection is similarly well organized. This selection also uses simile to facilitate comprehension of the unfamliar concept resilin: "...the resilin stretches like a rubber band when the flea is ready to jump."

The Spache selection consists of two paragraphs. This first is about a marble and the second about granite. While both are building stone, no attempt is made to compare or contrast these stones to facilitate comprehension. Further, the organization of ideas within each paragaph is not parallel, resulting in increased difficulty for the reader in processing and remembering the information. Since no main idea statement is provided, it will be difficult for the reader to identify the relationship between these two types of stone.

In short, passages at the sixth reader level are similar to those at the fourth reader level with the exception that they contain slightly more ideas and begin to introduce less familiar vocabulary and complex sentence structures. Of the three test passages evaluated, the Spache appears to be less comprehensible due to the number of ideas presented and poor text organization.

Test Comparisons

An examination was made of the changes in number of idea units and inferences contained in all the test passages from reader level two to six. The findings revealed that on the average the SDRT had the smallest number of idea units and inferences when compared with the other two tests, and the smallest increase in these variables from level two to six (M=10.5 idea units, M=3 inferences). The greatest number of idea units and inferences were found in the Spache selections along with the greatest increase in these variables from level two to level six (M=27 idea units, M=5 inferences). This summary data illustrates the differences in comprehensibility among these diagnostic tests which in principle were designed to assess students' comprehension ability at approximately the same reader levels.

Conclusion

The three reading diagnostic tests evaluated all purport to assess comprehenison ability at the second, fourth, and sixth reader levels. However, this evaluation has shown that the three tests differ substantially from one another with regard to the number of ideas presented, the number of inferences necessary to integrate these ideas, and text organization features. Although readability indices have been employed to identify the difficulty level of these passages, these indices reflect only surface features of the text and do not reflect the meaning characteristics of the passage nor identify the variables integral for deriving meaning from the text. As a result, these three tests contain features which decrease their comprehensibility and confound the assessment of comprehension ability with text comprehensibility.

Test authors have an obligation to apply the results from prose comprehension research and systematically control text variables in test passages designed for reading diagnosis. In the interim, however, teachers and diagnosticians use these tests regularly to identify children with reading comprehension problems. Based upon this analysis, it is suggested that teachers become knowledgeable about those text variables which influence comprehensibility. Tests which contain unfamiliar content, over-simplified or vaguely defined vocabulary, disjointed ideas, and poor text organization increase the processing demands of the reader and are less comprehensible. Thus, if at all possible should not be used for diagnostic purposes. If tests which contain these features have to be used due to state mandates or district guidelines, teachers will want to evaluate these tests with regard to the text variables discussed and consider to what extent a child has a comprehension problem and to what extent the text is poorly constructed thereby creating comprehension difficulties for the student.

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Footnote

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Table 1

Readability Indices and Text Variables in Second, Fourth and Sixth Reader Level Passages of Three Reading Diagnostic Tests

	TESTS								
Variables	Durrell			Spache			SDRT		
# Words	[a]54	[b]94	[c]128	[a]119	[b]216	[c]188	[a]53	[b]88	[c]88
# Sentences	5	6	7	9	16	17	6	6	5
# Syllables	67.5	131.1	187	147.5	292.4	273.7	75.8	114	124.7
Readability:									
ARI	2.3	6.8	9.1	3.3	5.2	5.4	3.9	4.9	8.1
Flesch-Kincaid	3.4	6.9	8.8	4.2	5.6	5.9	4.7	5.4	7.9
Harris-Jacobson	2.2	---	---	3.2	---	---	3	---	---
Dale-Chall	below 4th	5-6	7-8	below 4th	5-6	7-8	below 4th	4th or less	7-8
Content Familiarity	med-high	med-low	med-low	high	low	low-med	high	med	low
# Idea Units	20	35	56	50	95	104	22	35	43
# Text Based Inferences	5	11	16	15	27	25	5	7	11
Main Idea Statement	title	title first sentence	title	first sentence	-------	-------	-------	first sentence	first sentence

[a]Second Reader Level

[b]Fourth Reader Level

[c]Sixth Reader Level